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B. T. GALLOWAY, *Chief of Bureau.*

THE PRESENT STATUS OF THE CHESTNUT BARK DISEASE.

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Investigations in Forest Pathology.

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THE PRESENT STATUS OF THE CHESTNUT BARK DISEASE.

By Haven Metcalf, *Pathologist in Charge*, and J. Franklin Collins, *Special Agent, Investigations in Forest Pathology.*

HISTORY OF THE CHESTNUT BARK DISEASE.

In 1904 Mr. H. W. Merkel, of the New York Zoological Park, observed a disease which was destroying large numbers of chestnut trees in the city of New York. This disease is what is now known as the chestnut bark disease. Even at that time it is certain that it had spread over Nassau County and Greater New York, and had found lodgment in the adjacent counties of Connecticut and New Jersey. No earlier observation than this is recorded, but it is evident that the disease, which would of necessity have made slow advance at first, must have been in this general locality for a number of years in order to have gained such a foothold by 1904. Conspicuous as it is, it is strange that the fungus causing this disease was not observed or collected by any mycologist until May, 1905, when specimens were received from New Jersey by Mrs. F. W. Patterson, the Mycologist of the Bureau of Plant Industry. In the same year Dr. W. A. Murrill began his studies of the disease, publishing the results in the summer of 1906. By August, 1907, specimens received by this Bureau showed that the disease had reached at least as far south as Trenton, N. J., and as far north as Poughkeepsie, N. Y., and was spread generally over Westchester and Nassau counties, N. Y., Bergen County, N. J., and Fairfield County, Conn.

PRESENT DISTRIBUTION.

The present distribution of the chestnut bark disease is shown on the accompanying map (fig. 2). By this it will be seen that infection is now complete in the general vicinity of the city of New York. Outside of this area the disease already occurs at scattering points in a number of States. In every case its occurrence has been definitely authenticated by specimens which have been examined micro-

scopically. Reports have been received indicating that the disease is found at many other places, but not being substantiated by specimens these localities have not been shown on the accompanying map. It is only fair to state, however, that such reports have been received from points as remote as Cape Cod, Wellesley, and Pittsfield, Mass.; Rochester and Shelter Island, N. Y., and Akron, Ohio.

The bark disease is entirely different from a disease which during the past twenty years has caused the death of many chestnut trees on the Atlantic slope, particularly south of the Potomac River. The latter disease, which is now being studied by the Department of Agriculture, is associated with insects, is much slower in action than the bark disease, and produces a stag-headed condition of the tree. It can be quite confidently stated that the bark disease does not yet occur south of Virginia and at only a few points in that State.

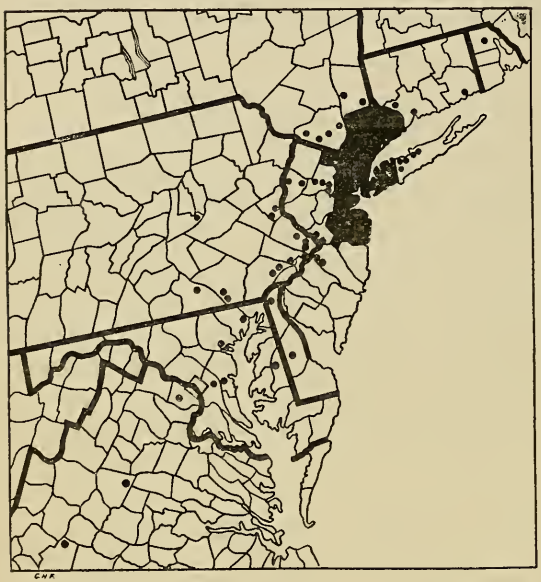

FIG. 2.—Map of the eastern portion of the United States, showing the distribution of the chestnut bark disease. The heavily shaded part shows the counties wherein infection is already complete. The round dots show other points where the disease is positively known to occur.

Investigations are in progress to determine the origin of the bark disease in America and the details regarding its spread. The theory advanced in a previous publication of this Bureau,[a] that the Japanese chestnuts were the original source of infection, has been strengthened by many facts. It yet lacks much of demonstration, however, and is still advanced only tentatively.

While the disease has spread principally from the vicinity of New York there is much to indicate that it occurred at other points at an early date. Chester's Cytospora on a Japanese chestnut, noted at Newark, Del., in 1902, may have been the bark disease. Observations by the junior writer indicate that this disease may have been present in an orchard in Bedford County, Va., as early

[a] Bureau of Plant Industry, U. S. Department of Agriculture, Bulletin 121, Part VI. 1908.

as 1903, and that in Lancaster County, Pa., it probably was present as early as 1905. All other points shown on the map outside of the area of general infection appear to have been infected only within one or two years.

The bark disease appears practically to exterminate the trees in any locality which it infests. A survey of Forest Park, Brooklyn, showed "that 16,695 chestnut trees were killed in the 350 acres of woodland in this park alone. Of this number about 9,000 were between 8 and 12 inches in diameter, and the remaining 7,000 or more were of larger size."

In a recent publication Dr. W. A. Murrill estimates the financial loss from this disease "in and about New York City" at "between five and ten million dollars." The aggregate loss throughout the whole area of country affected must be much greater.

The bark disease occurs on both chestnut and chinquapin, regardless of age, origin, or condition. It does not occur on any other tree so far as known. All reports of its occurrence on the chestnut oak (*Quercus prinus*) have proved to be unfounded. It is not yet known whether the goldenleaf chinquapin of the Pacific coast (*Castanopsis chrysophylla*) is subject to this disease.

According to Sudworth, the range of the native chestnut is "from southern Maine to northwestern Vermont (Winooski River), southern Ontario, and southern shores of Lake Ontario to southeastern Michigan; southward to Delaware and southeastern Indiana, and on the Allegheny Mountains to central Kentucky and Tennessee, central Alabama, and Mississippi." The range of the chinquapin is "from southern Pennsylvania (Adams, York, Franklin, and Cumberland counties) to northern Florida and eastern Texas (Neches River)." The bark disease may, therefore, be expected to occur at any point within these limits, as well as in any other localities where the chestnut is grown as an ornamental or orchard tree.

CAUSE AND SYMPTOMS.

The disease is caused by the fungus *Diaporthe parasitica* Murrill (also known as *Valsonectria parasitica* (Murrill) Rehm). The spores of this fungus, brought by some means from a previously diseased tree, enter the bark through wounds; possibly also in other ways. The leaves and green twigs are not directly affected. From the point of infection the fungus grows in all directions through the inner bark until the growth meets on the opposite side of the trunk or limb, which in this way is girdled. The wood is but little affected. Limbs with smooth bark attacked by the fungus soon show dead, discolored, sunken patches of bark covered more or less thickly with the yellow, orange, or reddish-brown pustules of the fruiting fungus.

In damp weather or in damp situations the spores are extruded in the form of long irregular "horns," or strings, at first greenish to bright yellow in color, becoming darker with age. Plate IV, figure 3, shows a part of a branch of a diseased chestnut tree magnified $3\frac{1}{2}$ diameters. In this illustration the typical appearance of the pustules in damp weather and the projection of the spores of the fungus in the form of "horns," or threads, are shown. These threads may be especially conspicuous near the edges of diseased areas. If the spot is on the trunk or a large limb with very thick bark there is no obvious change in the appearance of the bark itself, but the pustules of the fungus show in the cracks of the bark and, on account of the destruction of the layers beneath, the bark often sounds hollow when tapped. A patch usually grows fast enough to girdle the branch or trunk that it is on during the first summer.

The damage may not be immediately apparent, since the water supply from the roots continues to pass up through the comparatively uninjured wood to the leaves, but when in the following spring the new leaves are put out they are usually stunted and soon wither. The appearance of such trees is very characteristic. Plate IV, figure 1, shows large chestnut trees killed by the bark disease. In this illustration the trees to the left show the characteristic stunted foliage, which indicates that they were girdled during the previous year, while the tree on the right having no foliage was presumably girdled by the fungus at least two summers before the photograph reproduced was taken. Plate IV, figure 2, shows an orchard tree with recently girdled branches. Nothing else except an actual mechanical injury—breaking off of trunk or limb—produces such an effect as is shown in these illustrations. The imperfectly developed leaves often persist on the dead branches throughout the summer.

The great damage which the disease has done thus becomes most apparent in the last week of May or the first week in June, giving rise to the false but common idea that the fungus does its work at this time of the year, when in reality the harm is done during the previous summer. If the first attack is on the trunk, of course the entire tree dies. If, on the other hand, the small branches are first involved, the tree may live for several years.

It is very easy for a person not familiar with fungi to confuse this parasite with various other fungi which occur commonly on the dead wood of chestnuts and other trees, such as species belonging to the genera Calocera, Cytospora, and Cytosporina. The superficial resemblance is sometimes very strong, but a microscopical examination instantly reveals the true nature of the organism in question. On account of this common confusion no dependable diagnosis of the bark disease can be made in a new locality without a microscopical examination of specimens by an expert.

FIG. 1.—LARGE CHESTNUT TREES KILLED BY THE BARK DISEASE.

FIG. 2.—AN ORCHARD TREE, SHOWING RECENTLY GIRDLED BRANCHES.

FIG. 3.—PART OF A DISEASED BRANCH OF A CHESTNUT TREE, SHOWING TYPICAL PUSTULES AND FORM OF SPORE DISCHARGE IN DAMP WEATHER.

(Magnified 3 diameters.)

RESTRICTION OF SPREAD.

HOW THE FURTHER SPREAD OF THE BARK DISEASE MAY BE LIMITED.

By the Inspection of Diseased Nursery Stock.

It becomes more and more evident as this disease is studied that diseased nursery stock is the most important factor in its spread to distant points. In that part of the country where it is already well established in the native chestnuts its progress is rapid and sure, but there is no evidence at present that it is able to pass to remote districts, tens or hundreds of miles away, except on diseased nursery stock. Of course it is conceivable that the spores are carried by birds. Such distribution would, however, follow in general the great lines of bird migration north and south and hence would not be an important factor in the western spread, except locally. During the summer of 1908 nearly every chestnut nursery and orchard of importance in the Atlantic States north of North Carolina was visited, and very few were found free from the bark disease. Several cases were observed where the disease had obviously spread from the nursery to adjacent wild trees. This is the only way in which the disease is likely to spread beyond the Alleghenies.

It is therefore obvious that every State in which the chestnut or chinquapin grows should as speedily as possible pass a law putting the chestnut bark disease on the same footing as other pernicious diseases and insect pests, such as the San Jose scale, against which quarantine measures are taken. The Department of Agriculture will be glad to give detailed suggestions or advice regarding the framing of such laws. Inspectors who already have legal power to quarantine against this disease should now take special care that no shipment of chestnut stock escapes their rigid inspection.

A campaign of education should also be undertaken by pathologists and inspectors in every State in order to acquaint the public with the nature and appearance of the bark disease, so that it may be quickly recognized and stamped out in any particular locality in which it appears. The Department of Agriculture will cooperate in the following ways: Specimens from suspected trees sent in by any person will be promptly examined and the presence or absence of the disease reported. Typical specimens showing the disease (with the fungus previously killed by soaking in formalin to insure against any infection from this source) will be sent upon application to any inspector, forester, pathologist, or other State or experiment station officer, to any nurseryman or orchardist growing chestnuts, or to any botanist or teacher of botany. So far as the supply permits lantern slides and photographs will, upon application, be loaned for special lectures, exhibits, etc., to the officers of States, experiment

stations, or colleges. By these means the inspectors first, and then the general public, may become familiar with the appearance and work of the disease in localities that it has not yet reached, and when it does appear may be able to recognize it before it is too late to take efficient measures against it.

Although its present distribution is that shown by the map (fig. 1), the bark disease may be confidently looked for in any orchard or nursery in the United States that contains chestnut trees. All such places should therefore be rigidly inspected at the earliest possible date.

By the Prompt Destruction of Diseased Trees.

When the bark disease is first noticed in any locality, all the affected trees should be immediately cut down, unless, as in the case of orchard and some few ornamental trees, they are of sufficient individual value to warrant special treatment. Diseased trees if untreated are doomed to death in any case. If permitted to stand, every such tree becomes a center of infection, certain to spread the disease to all neighboring trees, and so long as it will soon die if left to itself the sooner it is cut down the better.

When cut, the brush should be immediately gathered and burned in order to destroy the fungus in the bark. Whenever the bark is removed from the trunk, as, for example, when the trees are to be used for poles, it should be immediately burned with the brush. Even when the tree is to be used for firewood an effort should be made to cut off at least all the diseased patches of bark on the trunk and large limbs when the tree is cut and to burn this bark along with the brush; otherwise the brush and the piled wood will continue to spread infection, since it has been found that the fungus continues alive on dead bark for at least six months after cutting.

Sprouts arising from the stumps of cut trees will be free from the disease for the first year at least, but must then be carefully inspected to be sure that no infection has persisted.

By the Treatment of Diseased Trees.

During the past two years the Office of Investigations in Forest Pathology has been conducting certain experiments and collecting information in regard to the best methods of treating diseased trees.

At present it is impossible definitely to record general beneficial results from any of the sprayings which have been undertaken or have been under observation. This may in part be due to the fact that it is yet too early to judge satisfactorily all the results and in part, perhaps, to the infrequency of sprayings.

Observations and experiments seem to bear out the statement that it is very improbable that any method of spraying can interfere with the growth of the fungus if it has once established itself in the inner bark, but it may be of considerable importance in preventing the development of spores which come from other trees or from other parts of the same tree.

It has already been demonstrated that the crotches of branches and enlarged bases of sprouts are very susceptible to infection because they are favorable places for the lodgment of water, dust, spores, etc. In a large majority of cases infections are definitely known to have originated at a point where the outer bark had been injured in some way, leaving the inner living bark exposed, or where the entire bark over a more or less limited area had been stripped from the tree or cracked and split away from the wood. Certain injuries which are known to have afforded entrance for the disease have been of such a nature that they might easily be overlooked, while others have been quite obvious, even to the careless observer. Among the latter may be mentioned broken limbs, split limbs, branches which have been carefully cut but not properly treated with tar or paint, bruises from hames, plows, and cultivators; also poor grafts and diseased grafting scions. Among the former may be included bruises from boot heels, climbing spurs, holes made by borers and other insects, knife and saw cuts, and frost cracks.

Almost the only treatment that can at present be safely recommended as surely retarding the spread of the disease to a greater or less extent is one which will never be of practical use except in the case of orchard trees or certain valuable ornamental trees. It consists essentially in cutting out the infected branches or areas of bark and carefully protecting the cut surfaces from outside infection by means of a coat of paint or tar. This cutting must be thoroughly done and the bark of every infected place entirely removed for a distance of at least an inch (where the size of the branch permits) beyond the characteristic, often fan-shaped, discolored areas produced by the growing fungus in the inner bark. All small infected twigs or branches should be cut from the tree, the cut being made well back of the diseased area. A pruning knife with an incurved tip, a hollow gouge, or any other clean-cutting instrument will serve for cutting out diseased spots. So far as the exigencies of the case will permit, all borers' holes should be cut out. It has been repeatedly observed in the field that infection often starts where borers are at work, or even at the old holes made by them. The paint or tar may be applied by means of a good-sized brush, care being taken to cover every part of the cutting. Treatment should begin, or observations at least, at the base of the tree and the fact ascertained whether the disease has

already girdled the trunk. If such is the case it will be a waste of time to attempt any treatment; instead, cut the tree down at once. A rigid watch must be kept, especially during the growing season, for new infections or infections which were overlooked in the earlier examinations, and if any are observed they must be treated promptly, as above mentioned. Constant vigilance is necessary to keep the disease in check. It is suggested that examinations be made about June 1, July 15, and September 1. During a very rainy or foggy season, when conditions are particularly favorable for the growth of fungi, it may be advisable to inspect as often as once a month.

In regions in which the disease is so widespread that almost every tree is infected, as, for instance, within 25 miles of the city of New York, it is extremely doubtful whether any individual treatment will pay. Under such conditions immediate reinfection is almost sure to occur at one or more of the small unnoticed abrasions or injuries which are quite certain to exist on most trees. In a region, however, where only isolated cases have yet appeared it is quite possible to stamp out the disease, or at least to prevent its rapid spread, by promptly cutting out and carefully burning all diseased bark and limbs, thus destroying these new sources of infection. If a tree is too badly infected to be worth treating it should not be left standing, for it will then become a continual menace to all surrounding chestnuts.

The Office of Investigations in Forest Pathology asks the cooperation of all persons who have observed the disease or experimented with it in any way. If such people will send in an early report of the kind of treatment used, time of treatment, methods employed, and results obtained (even if adverse), it may be possible to arrive at an earlier and more definite conclusion in regard to the possibilities or impossibilities of control than would otherwise be the case.

CONCLUSIONS.

It is to be hoped that in the economy of nature some limiting factor will arise to check the spread of the bark disease before it has wrought the same destruction throughout the country that it already has in the vicinity of New York. But at present there is nothing in sight that promises even remotely to check its spread into new territory except the general adoption of the measures advocated in these pages. It can not be argued that because of its apparently recent origin and rapid spread it will soon disappear of itself. Such diseases as pear-blight and peach yellows have been in the country for more than a century and yet show no sign of abating except when actively combated by modern quarantine methods. Nor can any conclusions be drawn from the fact that chestnuts in the Southern

States have suffered from a disease during the past twenty years, since, as already stated, that is a totally different thing from the bark disease.

Where the bark disease is already firmly established and has attacked 50 per cent or more of the chestnut trees, as in the vicinity of the city of New York, it is probably too late to try to do anything, but where the disease is just appearing there is no reason to doubt that strict quarantine methods will apply as well to this as to any other disease, whether of plants or animals. The question to settle is simply which is more costly—to use the methods recommended or to lose the trees. The people concerned must decide.

BIBLIOGRAPHY.

CHESTER, F. D. Blight of Japanese chestnuts. 14th Ann. Rept., Del. Coll. Agr. Exp. Sta. for 1902, pp. 44–45. 1903.

GASKILL, A. The chestnut blight. 3d Ann. Rept., Forest Park Reservation Commission of New Jersey for 1907, pp. 45–46. 1908.

HODSON, E. R. Extent and importance of the chestnut bark disease. Circ. [unnumbered], Forest Service, U. S. Dept. Agr., Oct. 21, 1908.

MERKEL, HERMANN W. A deadly fungus on the American chestnut. 10th Ann. Rept., N. Y. Zoological Society, pp. 96–103. 1906.

METCALF, HAVEN. Diseases of ornamental trees. Yearbook, U. S. Dept. Agr., for 1907. Pages 489–490 contain an account of the chestnut bark disease.

——— The immunity of the Japanese chestnut to the bark disease. Bur. Plant Ind., U. S. Dept. Agr., Bul. 121, pt. 6. 1908.

MORRIS, ROBERT T. Chestnut timber going to waste. Conservation, vol. 15, no. 4, p. 226. 1909.

MURRILL, WILLIAM A. A new chestnut disease. Torreya, vol. 6, no. 9, pp. 186–189. 1906.

——— Further remarks on a serious chestnut disease. Jour. N. Y. Bot. Gard., vol. 7, no. 81, pp. 203–211. 1906.

——— A serious chestnut disease. Jour. N. Y. Bot. Gard., vol. 7, no. 78, pp. 143–153. 1906.

——— The chestnut canker. Torreya, vol. 8, no. 5, pp. 111–112. 1908.

——— Editorial paragraph in Mycologia, vol. 1, no. 1, p. 36. 1909.

——— Spread of the chestnut disease. Jour. N. Y. Bot. Gard., vol. 9, no. 98, pp. 23–30. 1908.

REHM, H. Ascomycetes exs. Fasc. 39, No. 1710. Annales Mycologici, vol. 5, no. 3, p. 210. 1907.

STERLING, E. A. Are we to lose our chestnut forests? Country Life in America, vol. 15, no. 1, pp. 44–45. 1908.

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